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ABSTRACT

A study examined (1) relationships between background knowledge and reading passage comprehension, (2) the reliability of a passage-specific background knowledge measure used as the knowledge criterion, (3) the effect of a prereading language and concept organizer activity on available background knowledge, and (4) the effect of that prereading activity on responses to specific who, what, when, where, how, and why (wh) questions as well as on total comprehension. The subjects, 161 Long Island, New York, sixth grade students, were assigned to four prereading activities: prereading plan (PreP) group discussion of key concepts, motivation discussions of specific questions in small groups, no activity (reading without any preparatory discussion), and a distractor discussion of a nonrelated topic. Two passages from a social studies text were selected for reading, and students completed a 20-item test measuring wh comprehension. The results indicated that the background knowledge measure was a significant and reliable predictor of wh comprehension. The prereading activity significantly raised available background knowledge, and this in turn increased comprehension of moderately difficult passages. The measure of text specific background knowledge may be useful for teachers in assessing the difficulty of a reading assignment, and for researchers in controlling for differences in prior knowledge or in examining the relationships between background knowledge and various aspects of learning. (HTH)

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EXAMINING BACKGROUND KNOWLEDGE AND TEXT COMPREHENSION

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Abstract

This study examined 1) relationships between background knowledge and passage comprehension, 2) the reliability of a passage-specific background knowledge measure used as the knowledge criterion, 3) the effect of a pre-reading language and concept organizer activity on available background knowledge, and 4) the effect of that pre-reading activity on responses to wh questions of specified types as well as on total comprehension. Passage specific background knowledge, based on free association stimulated by key content words, was measured by categorization levels developed by Langer, 1980. Findings suggest that the background knowledge measure is a significant and reliable predictor of wh comprehension. The pre-reading activity significantly raises available background knowledge, and this in turn increases comprehension of moderately difficult passages. The measure of text specific background knowledge may be useful for teachers in assessing the difficulty of a reading assignment, and for researchers in controlling for differences in prior knowledge or in examining the relationships between background knowledge and various aspects of learning.

EXAMINING BACKGROUND KNOWLEDGE AND TEXT COMPREHENSION

BACKGROUND

The knowledge and experience an individual brings to a reading task are critical factors in comprehension. In drawing meaning from text, readers build their own elaborations; they "read" situational demands, review personal knowledge, and select what seems most appropriate and useful for the task at hand. Researchers from diverse fields have reminded us that comprehension is always to some extent idiosyncratic (Langer, 1978), building on individuals' responses to the pragmatics of the particular reading situation as well as their understanding of the "content" of the text (Anderson, Pichert, and Shirey, 1979; Goodman, K. and Goodman, Y., 1978; Gumperz, Simons, and Cook-Gumperz, 1982; Heath, in press; Steffensen, Jogdeo, and Anderson, 1979; Tannen, 1982).

One set of factors which influence how an individual will interpret a particular passage stems from the nature and extent of previous knowledge about the topic. A number of studies have examined the relationship between background knowledge and comprehension. Chi (1978) showed that children with strongly developed schemata recall, predict, and monitor more like older students than their age mates with less developed knowledge. Pearson, Hansen, and Gordon (1979) similarly found that wh comprehension was

significantly affected by strength of prior knowledge, but the effects were more pronounced on scriptally-explicit than textually-explicit questions. Gagne et al (1981) measured recall as opposed to wh comprehension and found that more familiar passages were learned faster and remembered better than less familiar passages. Gagne concluded that more extensive knowledge allows readers to elaborate content on their own.

Although the notion that relevant background knowledge is directly related to comprehension and recall should come as no surprise, its importance leads directly to a further question: Can passage-specific background knowledge be reliably estimated prior to reading? If so, can this information be used in making decisions about appropriate instructional techniques surrounding a given reading experience?

Categorizing Passage-Specific Prior Knowledge

Langer (1980) developed a system for categorizing the quality of knowledge that a reader possesses about key concepts in a text. Passages were selected from texts read by students in grades three through graduate school. Key words or phrases were then selected as representing the major concepts in each passage. Students were asked to free associate in response to each concept selected from the passage -- to jot down anything that came to mind when they

heard that particular word or phrase. Following these procedures, some three thousand responses were gathered for content analysis. Although early in the analysis a variety of systems were considered for categorizing students' responses, twelve subcategories representing four distinct levels of organization of knowledge eventually proved sufficient. The lowest level of organization contained responses that at first seemed uncategorizable -- they showed no apparent link to preexisting knowledge. In later studies these responses were so infrequent that this group was collapsed with other responses reflecting little lowest prior knowledge level (see Langer, 1980; Langer & Nicolich, 1981). The resulting three levels of organization include the following categories of response:

1. MUCH -- (Highly Organized)

superordinate concepts - higher class category

e.g., fascism - "one of the various forms of political rule..."

definitions - precise meaning

e.g., dictator - "a ruler with absolute authority over the government of a people"

analogies - substitution or comparison for a literal concept or expression

e.g., court - "court is the scale that weighs

your destiny"

linking - connecting one concept with another

e.g., congress - "congress is like parliament in that both..."

2. SOME - (Partially Organized)

examples - equal class, but more specific

e.g. government - "dictatorship"

attributes - subordinate to larger concept

e.g., court - "trust in the judgment of others"

defining characteristics - defines a major aspect of the concept

e.g., government - "makes laws"

3. LITTLE - (Diffusely Organized)

associations - tangential cognitive links

e.g., congress - "important people"

morphemes - smallest units of meaning such as prefixes, suffixes, and root words

e.g., binary - "bicycle"

sound alikes - similar phonemic units

e.g., gerrymander - "salamander"

first hand experiences - tangential responses based on recent exposure

e.g., Iran - "news on television"

no apparent knowledge

Langer's levels of passage-specific knowledge are related to the categories of conceptual development described by Vygotsky and Bruner. In his study of concept formation, Vygotsky (1962) identified three phases of conceptual complexity, ranging from the more subjective and diffuse to the more objective and organized. At the lowest level, Vygotsky claimed that knowledge is organized around poorly articulated images and objects related only by the immediate perception of the observer. At the next level, concrete relationships are formed around more objectively recognizable bonds. At the highest level, abstract, symbolic relationships are recognized.

Bruner, in his work with Goodnow and Austin (1956), identified three groups of conceptual categories: formal, functional, and affective. Formal concepts are constructed by specifying properties or attributes that are intrinsic to the entire class. They develop concurrently with their symbolic representation. Functional concepts focus on a specific function; they are concrete and objective. Affective concepts are personally based and not amenable to ready description.

Although developed at different times for different purposes, Vygotsky's stages of concept development, Bruner's bases for concept categorization, and Langer's topic-

specific knowledge differentiations are strikingly parallel. In each case, there is a progression from 1) a diffuse, personal response, to 2) a concrete, functional response, to 3) an incorporation of abstract, superordinate principles.

Recall and Levels of Passage-Specific Knowledge

Langer (1980) examined the relationship between these levels of text related knowledge and the recall of information from text. In this investigation, Langer selected two passages from Meyer's (1975) work on the organization of prose and the structure of recall. Three major content words were selected from the top half of each passage's content structure for use as free association stimuli. High school seniors were given each content word separately and told to write anything that came to mind when they heard that word. After the three words for a passage had been given and all free associations elicited, the students read the passage silently and then wrote all they could remember about the passage. The free association responses were assigned to one of the three prior knowledge categories (see pp. 3 and 4) and were weighted from 3 (highly organized) to 1 (diffusely organized) knowledge. The recall protocols were scored using Meyer's categories for hierarchical structure of passage content. Correlation analyses indicated that Langer's measure of prior knowledge was highly related to the readers' recall.

A follow-up study (Langer & Nicolich, 1981) more fully examined the relationship between prior knowledge and the organization of recall. Findings from a principal components analysis indicated that although slightly different patterns were observed for the two passages used in the study, both the level of prior knowledge and the various recall measures had major loadings on the first component, while measures of IQ and general reading comprehension loaded on later components. A series of analyses indicated that level of prior knowledge (as measured by Langer's system) was highly related to recall, independent of the reader's I.Q. or general reading level.

PReP: A Pre-Reading Activity

During the three year period in which the prior knowledge categories were devised and analyzed, Langer (1980, 1981a,b, 1982) also developed a pre-reading activity to draw upon and elaborate existing knowledge. This activity integrates instructional assessment with pre-reading instruction and was designed to create conditions under which students' text related knowledge is likely to be brought to awareness and applied. The PReP (Pre REading Plan) emanates from the same conceptual framework as the prior knowledge categories: text specific concept and vocabulary knowledge affect the processing, interpretation, and recall of what is read. (For further discussion see

Langer, in press and Langer, in preparation.)

In the PReP, teachers provide a climate of inquiry that allows students to draw upon what they already know about a topic, and group discussion encourages students to reflect upon the appropriateness of their ideas in relation to the specific reading task. In preparation for PReP the teacher selects key words that are central to the understanding of the text the students will read. PReP consists of three phases:

1. Initial Associations With the Concept - "Tell me anything that comes to mind when..."
2. Reflections on Initial Associations - "What made you think of..."
3. Reformulation of Knowledge - "Based on our discussion, have you any new ideas about..."

From 1978-1981 the PReP activity was used by many teachers in grades three through graduate school. Teacher acceptance of the activity as a teaching and assessment aid was continually high and helped shape research plans to further analyze its effectiveness as an instructional tool.

The study presented here was an outgrowth of the theory and research cited above and was designed to continue investigation of the relationships between prior knowledge and comprehension. The study was conducted to determine 1) the predictive power of the prior knowledge measure on comprehension, 2) the reliability of that measure across

time, 3) the effect of the pre-reading language and organizer activity (PReP) on available prior knowledge, and 4) the effect of that pre-reading activity on aspects of wh comprehension.

METHOD

Subjects

Subjects for this investigation were 161 sixth graders from a middle class suburban school system on Long Island, New York. They were classified as high (over 6.5), average (5.5 to 6.5), or low (under 5.5) readers based on their reading comprehension subtest score on the Iowa Test of Basic Skills. Reading comprehension scores ranged from 2.4 to 9.6 with a mean of 5.8. I.Q. scores from the group administered Cognitive Abilities Test were available for 130 subjects. Scores ranged from 79 to 149; the mean was 112.

Materials

Two passages, one about World War I and one about Stonehenge, were selected from Culture, a sixth grade social studies text published by Allyn and Bacon. Each passage was approximately 700 words in length. A 20-item criterion measuring wh comprehension was prepared for each passage. To develop this measure, two research assistants separately identified the superordinate and subordinate concepts contained in each paragraph. (There were fifteen paragraphs

in the World War I passage and 16 in the Stonehenge passage.) Twenty questions were then developed as the criterion measure for each passage, 10 dealing with superordinate and 10 with subordinate information. In addition, each of the 10 were evenly divided into textually explicit questions (based on information directly stated in the text) and textually implicit questions (whose answers could be inferred from the text). When the wh questions had been agreed upon by the researchers, the questions were submitted to 10 elementary school reading teachers for review of their similarity to questions generally asked in school comprehension activities. At their suggestion, one of the twenty was revised. The following examples illustrate the types of questions that resulted:

Sample Questions

TEXTUALLY EXPLICIT SUPERORDINATE - Where did Hawkins think the answer to Stonehenge was?

a. in astronomy

b. in ancient customs

c. in old theories

TEXTUALLY EXPLICIT SUBORDINATE - How did people move the huge stones over long distances?

a. by astronomy

b. by wheels

c. by boat

TEXTUALLY IMPLICIT SUPERORDINATE - Why did Karl Marx want a dictatorship by the people?

a. he wanted the Czar to rule the country

b. he believed the workers should own the means of production

c. he wanted the Russian people to revolt

TEXTUALLY IMPLICIT SUBORDINATE - Why were new industries growing in the United States and Japan since the fighting was mostly in Europe?

a. the war hadn't destroyed the industries in the United States and Japan since the fighting was mostly in Europe

b. Europe now had less economic power

c. the United States and Japan needed more war materials produced than Europe because they had a greater population

For the measure of passage-specific knowledge, three key words were selected from the top half of the content structure of each passage. They were World War I, communism, and economy for the World War I passage and Stonehenge, astronomer, and heelstone for the Stonehenge passage. Prior to administering the free association task, two teachers reviewed the researchers' selection of key words and corroborated their centrality as major concepts in the passage.

Pre-Reading Activities

Four different pre-reading activities were planned:

1. PReP: group discussion of key concepts, following the steps outlined in the previous section;
2. Motivation: a general discussion of the topic -- this was meant to replicate the kind of motivation discussions often suggested as pre-reading activities in teachers manuals, and frequently used by teachers to introduce their lessons. The specific motivation activities used in this study were developed after observing and consulting with sixth grade teachers about their procedures for introducing new reading assignments.

   Motivation discussions tend to be less focussed than in PReP and often involve just a few students in the actual dialogue -- while the others remain uninvolved. In the study, the question, " How many of you have ever heard of World War I? Tell us about it," began the discussion.
3. No Activity: reading without any preparatory discussion;
4. Distractor: reading following a general, non-topic related discussion taking the same amount of time as the PReP and Motivation activities.

When the data were analyzed, group 4 (the distractor

group) had a much narrower range of scores for reading achievement and IQ; they also had significantly higher IQ and initial reading achievement scores than any of the other three groups ($p < .01$). Because of these pretreatment differences, this group was excluded from the analyses of treatment effects.

Procedures

Research asistants administered the measures to students in groups of 10 or 11, in three sessions. During the first session, students completed either the free association measures for the two passages, or a distractor activity requiring free association to stimulus words unrelated to either passage. The second and third sessions were scheduled one week later, each consisting of a prereading activity, a repeat of the free association measure (actually, a first administration of the passage-specific measure of prior knowledge for students who received a distractor in session I), reading of the passage, and completion of the 20-item criterion measure. After a break, this pattern was repeated for the second passage. Order of the passages was counterbalanced within each treatment group.

Thus, for each passage, the measures and activities occurred in the following order:

Group1(n=39)	Group2(n=42)	Group3(n=38)	Group4(n=42)
FA1	FA1	FA1	Distractor
PReP	Motivation	No activity	Distractor
FA2	FA2	FA2	FA2
Text Reading	Text Reading	Text Reading	Text Reading
Questions	Questions	Questions	Questions

ANALYSIS AND FINDINGS

Reliability of Measure of Passage-Specific Knowledge

The free association responses were scored on a three point scale (as described above), with 3 representing more organized and 1 representing more peripheral knowledge. Two judges scored the responses for each passage's three stimulus words separately. A student's score for a particular passage was the average of the scores for all three stimulus words. Interrater agreement was relatively high (.86) and in cases of disagreement an average of the two scores was computed.

Test-retest correlations were calculated to determine the reliability of the prior knowledge measure across conditions (FA1 and FA2 by condition). Findings (see Table 1) indicate a high correlation between the first and the second prior knowledge measure (FA1 with FA2) within each group.

Insert Table 1 about here

As would be expected, the no intervention group had the highest reliability since there was no treatment activity to affect available knowledge. The lowest correlations appeared in the PReP condition, the activity which most strongly affected available background knowledge.

Predictive Validity of the Measure of Passage-Specific Knowledge

To assess the predictive power of the prior knowledge measure, partial correlations were computed with passage comprehension, controlling for standardized reading score and IQ (see table 2). Results indicated that the prior knowledge measure elicited just before the passages were

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Insert Table 2 about here

---

read (FA2) is significantly predictive of wh comprehension at the .01 level or better. This effect is in addition to the influence of IQ and general reading comprehension, both of which are also related to the passage comprehension scores.

Correlations between prior knowledge and the various comprehension subscores were also compared. For both passages, the correlations with prior knowledge were significantly higher ($p < .05$) for the superordinate than

for the subordinate questions. The prior knowledge measure showed no consistent differences in its power as a predictor of responses to textually explicit and textually implicit questions.

Another question addressed in this analysis focussed on whether the total number of responses given for the key concepts in any particular passage (that is, a frequency score) would be as good a predictor of comprehension as the complexity or abstraction of the responses (that is, a quality score) as measured by the weighted procedure described above. Hare (1982) found a simple topic knowledge count to be a higher predictor of total idea unit recall than the qualitative score.

To investigate this question, scores for the three main treatment groups were recalculated as simple counts of responses representing much, some, and little prior knowledge for each of the stimulus words for each passage. Partial correlations controlling for IQ and reading achievement were then computed to determine the relationships between various frequency counts and total comprehension. Findings indicate that simple frequency counts do correlate significantly with comprehension (see Table 3). However, the magnitude of the relationships is only about one third that obtained using Langer's qualitative scoring procedures. Partial correlations between

frequency scores and the various comprehension subscores

Insert Table 3 about here

were much lower, ranging from .21 to -.26, with a median correlation of .06. These results suggest that the qualitative score is more strongly related to comprehension that are any of the scores based on frequency counts.

Effects of Pre-Reading Activitities

In examining the effect of pre-reading activities on comprehension, it was anticipated that effects would be largest with PReP, followed by the motivation and the no intervention conditions. An analysis of covariance (treatment by reading achievement level) controlling for the effects of pretreatment knowledge (FA1) was performed to determine the effect of the pre-reading activities on passage-related knowledge available for the reading task. Results indicate that the pre-reading activities had a significant effect on passage-related prior knowledge for both passages at $p < .01$ (see Table 4).

Insert Table 4 about here

As anticipated, PReP had the largest effect on both passages, followed by the motivation activity. The treatment by reading level interaction was significant for the

Stonehenge passage, reflecting greater gains in passage-specific knowledge levels for the on-level reading group receiving the PReP activity.

To test the effects of the prereading activities on passage comprehension, a repeated measures analysis of covariance was used on the comprehension subscores (treatment by passage by reading level by subordinate/superordinate by textually implicit/textually explicit questions), with initial passage-specific knowledge levels (FA1) as a covariate. Table 5 displays the main effects and interactions for treatment condition, passage, and reading achievement level. Results indicated that the treatment condition by reading level interaction tend towards significace ($p < .06$). In general, the lowest achieving sixth grade readers (under 5.5) were not affected by the prereading activities.

Insert Table 5 about here

The highest achieving readers (over 6.5) were somewhat inconsistent in their reactions to the prereading activities; the PReP group scored significantly higher than those receiving the motivation activity, but not significantly higher than the group that participated in only a distractor activity. The pattern for the on-level group paralleled their gains in passage-specific knowledge;

scores were highest for the PReP group and lowest for the distractor group, with the motivation group falling in between.

Difficulty of Question Types

Table 6 displays the results for comprehension subscores by treatment and achievement level effects, from the repeated measures analysis of covariance. Results indicate that across passages, textually implicit questions were more difficult than textually explicit ($p < .0001$) and that superordinate questions were more difficult than subordinate ($p < 0001$).

Insert Table 6 about here

Treatment effects also differed by reading level and type of question. For the on-level group, the PReP activity was most helpful in improving their responses to the question types of intermediate difficulty, those classified as subordinate textually implicit and superordinate textually explicit questions. It is likely that for this group, the superordinate implicit questions were sufficiently difficult that the PReP activity was not particularly helpful, while the textually explicit subordinate questions were sufficiently easy that the PReP activity was not needed.

As was apparent in the main effects displayed earlier (table 5), the below level group did not benefit significantly from any of the treatments. The above level achievers reacted differentially to the PReP activity in that their responses to the easier questions (textually explicit superordinate and subordinate) were not affected by the activity, while their responses to the more difficult textually implicit subordinate and superordinate questions were aided by the PReP activity.

Passage Differences

Since the FA1 and FA2 variances for the Stonehenge passage were smaller than those for World War I, a t-test for correlated variances was used to compare them. Findings showed that there was a significant difference between the free association variances across passages ($p < .001$). Since the Stonehenge passage was very narrowly constructed around the specific astronomical uses of Stonehenge, the stimulus words for this restricted topic may have been too limiting (either you know it or you don't) and did not permit the range of lower-level partially-related responses that were elicited by the prompts for the other passage. It is possible that in certain cases 3 prompts may not suffice as topical knowledge probes, or perhaps key words need to be selected from among those concepts that are more general although lower in the content hierarchy. (For suggestions on prompt selection, see Newell, in preparation.) Although

the range of scores for passage-specific prior knowledge was restricted for the Stonehenge passage, there were no main or interaction effects reflecting passage differences in the analysis of comprehension subscores.

DISCUSSION

Findings indicate that the passage-specific knowledge measure developed by Langer is highly related to passage comprehension and is a good and reliable predictor of wh comprehension as well as of recall. The related prereading activity, PReP, significantly raises the level of knowledge that readers of all achievement groups have available to bring to the reading task. This, in turn, helps raise the comprehension of average achievers and high achievers on the question types they find to be of moderate difficulty. Comprehension of the lower achieving students was not affected by PReP; it is likely that these students need direct instruction in passage-related concepts.

Due to its strong relationship with passage comprehension and recall and its reliability over time, Langer's measure of passage-specific knowledge appears to be a promising research tool for the control of prior knowledge as well as for examining the effects of topic specific knowledge on particular kinds of learning in particular contexts.

The findings also suggest that the prior knowledge

measure may be useful to teachers in determining when a particular textbook is appropriate either for individual or class assignment. It could also assist in determining whether, and for whom, direct concept and vocabulary instruction is adviseable.

The PReP activity had a strong effect on the comprehension of average achieving readers and a more differential effect on the comprehension of the better readers. Further study needs to examine the effects of the PReP activity on retelling and on delayed comprehension. Because the availability and organization of topic-specific knowledge is an important aspect of writing as well as of reading, both Langer's measure of topic-specific knowledge and the PReP activity may have useful adaptations in the field of writing. It is hoped that additional research issues and questions will emerge as teachers use the activity in their regular instructional programs.

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Table 1. Test-Retest Correlations for Prior Knowledge Measure

Condition	Passage 1	Passage 2	N
PReP activity	.75	.56	39
Motivational activity	.85	.56	40
No intervention	.86	.68	38

Table 2. Relationships Between Prior Knowledge (FA2) and Comprehension, Controlling for IQ and Reading Achievement Level

	Partial Correlations	
	Passage 1	Passage 2
Comprehension measures		
Total	.45	.46
Superordinate	.43	.46
Subordinate	.34	.37
Textually explicit	.35	.47
Textually implicit	.37	.33
Textually explicit: superordinate	.34	.41
Textually explicit: subordinate	.27	.38
Textually implicit: superordinate	.32	.32
Textually implicit: subordinate	.30	.20*
Degrees of freedom	125	124

*$p < .01$, all others $p < .001$

Table 3. Partial Correlations of Total Comprehension Scores with Qualitative and Frequency Scores, Controlling for IQ and Reading Achievement Level

Predictors	Passage Comprehension	
	Passage 1	Passage 2
Qualitative Score	.59	.46
Frequency Scores:		
Total Responses	.18	.15
Total Much Prior Knowledge	-.03	.06
Total Some or Much Prior Knowledge	.18	.09
Degrees of Freedom	88	82

Table 4. Post Treatment Prior Knowledge Scores

	Adjusted Means			
Condition	Passage 1	(N)	Passage 2	(N)
PReP activity	132	(39)	121	(39)
Motivational activity	120	(37)	114	(37)
No intervention	113	(34)	112	(31)

Effects[1]		
Condition	15.46***	4.98**
Reading level	3.78*	10.33***
Condition x reading level	1.36	4.62***

*** $p < .001$
** $p < .01$
* $p < .05$

[1]From condition x reading achievement level analyses of covariance, controlling for pre-treatment prior knowledge score

Table 5. Comprehension Means by Treatment and Reading Achievement Level

	Adjusted Means (controlling for pretreatment prior knowledge)		
Condition	Below grade	On grade	Above grade
PReP	20.6	26.0	25.0
Motivation	19.9	24.1	21.1
No intervention	21.7	20.9	24.4
N	47	35	25

Effects[1]

Passage	$F = 0.01$
Condition	$F = 2.69$, $p < .07$
Achievement	$F = 3.25$, $p < .04$
C x A	$F = 2.37$, $p < .06$
Passage x Condition	$F = 1.63$

[1]From passage x condition x reading level x explicit/implicit x superordinate/subordinate analysis of covariance

Table 6. Comprehension Subscores by Treatment and Reading Achievement Level

	Adjusted Means (controlling for pretreatment prior knowledge level)			
	On-Level Group			
	Textually Implicit		Textually Explicit	
Condition	Superordinate	Subordinate	Superordinate	Subordinate
PReP	4.7	6.2	7.5	7.6
Motivation	4.8	5.5	6.2	7.5
No intervention	4.4	4.2	5.4	7.0
	Below Grade			
PReP	4.5	5.0	5.0	6.0
Motivation	4.2	4.5	5.3	6.0
No intervention	4.5	5.1	6.8	6.0
	Above Grade			
PReP	5.1	6.4	6.5	7.2
Motivation	2.2	4.9	7.2	6.9
No intervention	4.5	5.6	6.7	7.6

Effects[1]

Explicit-Implicit	$F = 89.96$, $p < .0001$
Superordinate-Subordinate	$F = 26.22$, $p < .0001$
E x S	$F = 1.02$
Condition x E x S x Achievement	$F = 2.46$, $p < .05$

[1]From passage x condition x reading level x explicit-implicit x superordinate-subordinate analysis of covariance